National Institute of Technology, Hamirpur (HP)
End Semester Theory Examination
RCC Design, CE-311
November. 2023

Maximum Marks: 50

Time Allowed: 3Hr

Note: Attempt any five questions. Any missing data may be assumed.
All questions carry equal marks.
Use of IS: 456-2000, SP 16 is allowed is allowed.

1. (a) Determine the moment of resistance of Singly reinforced beam 300 mm wide and 600 mm deep to the soffit of beam. The beam is reinforced with 4 bars of 20 mm diameter at a clear cover of 30 mm from soffit of beam. The concrete used is M20 grade and steel is Fe 415 grade. (5)
   (b) Why is the maximum compressive stress in concrete assumed as 0.67 fck in the design of RCC Structures as adopted in IS: 456-2000? (2.5)

   (c) Is there any limiting or maximum value of xu? If so, why? What is the expression to find the maximum value of xu? (2.5)

2. Design the longitudinal and shear reinforcement for a 300 mm wide concrete beam supported on two walls 350 mm thick, spaced at a clear spacing of 6 m. The beam carries a superimposed load of 50 kN/m exclusive of its self-weight. The overall depth of the beam is restricted to 500 mm. Design the beam using M20 grade of concrete and Fe 500 grade of steel to provide fire resistance for 2 hours. The beam is required to be exposed to a moderate environmental condition. Draw a suitable sketch showing the details of reinforcement. (10)

3. An interior panel of a slab continuous on all sides has dimensions 4.5 m x 5.0 m. The thickness of the supporting beams is 300 mm. The slab carries a 100 mm thick lime concrete in addition to its own thickness at its top, whose unit weight is 19kN/m². The live load on the slab may be taken as 4 kN/m². Design the slab panel using M20 grade of concrete and Fe415 grade of steel to provide a fire resistance for 2 hours. The unit weight of concrete may be assumed as 24 kN/m³. Draw a suitable sketch showing the details of reinforcement. (10)

4. Design a waist slab type dog legged staircase for an office building using the following data. The height between floors is 3.2m. Tread = 270 mm and riser

=160 mm. Width of flight = landing width =1.25 m. The stairs are supported on edges of landing slab. The landing slab is supported on 300 mm load bearing masonry walls at the outer edges of the landing, such that landing spans parallel to the risers. Use M20 grade of concrete and Fe 415 grade of steel. Also design the landing slab. Show the reinforcement details by a sketch in plan and section. (10)

5. Determine the load carrying capacity of a short circular reinforced concrete column 400 mm diameter, reinforced with 8 bars of 20 mm diameter and 8 mm spiral at a pitch of 120 mm. The clear cover to the longitudinal reinforcing bars is 35 mm. The grade of concrete used is M25 and grade of steel is Fe 500. (10)

6. Design a rectangular footing for a Reinforced Concrete column carrying an axial load of 1200 kN having a size of 400 mm x 600 mm. The safe bearing capacity of the soil may be taken as 150 kN/m^2. Use M20 grade of concrete and Fe 415 grade of steel. Check the designed footing for shear, and transfer of load at the base of column. If required design the reinforcement required for transferring the load from column to footing. Show the reinforcement details by a sketch in plan and section. (10)